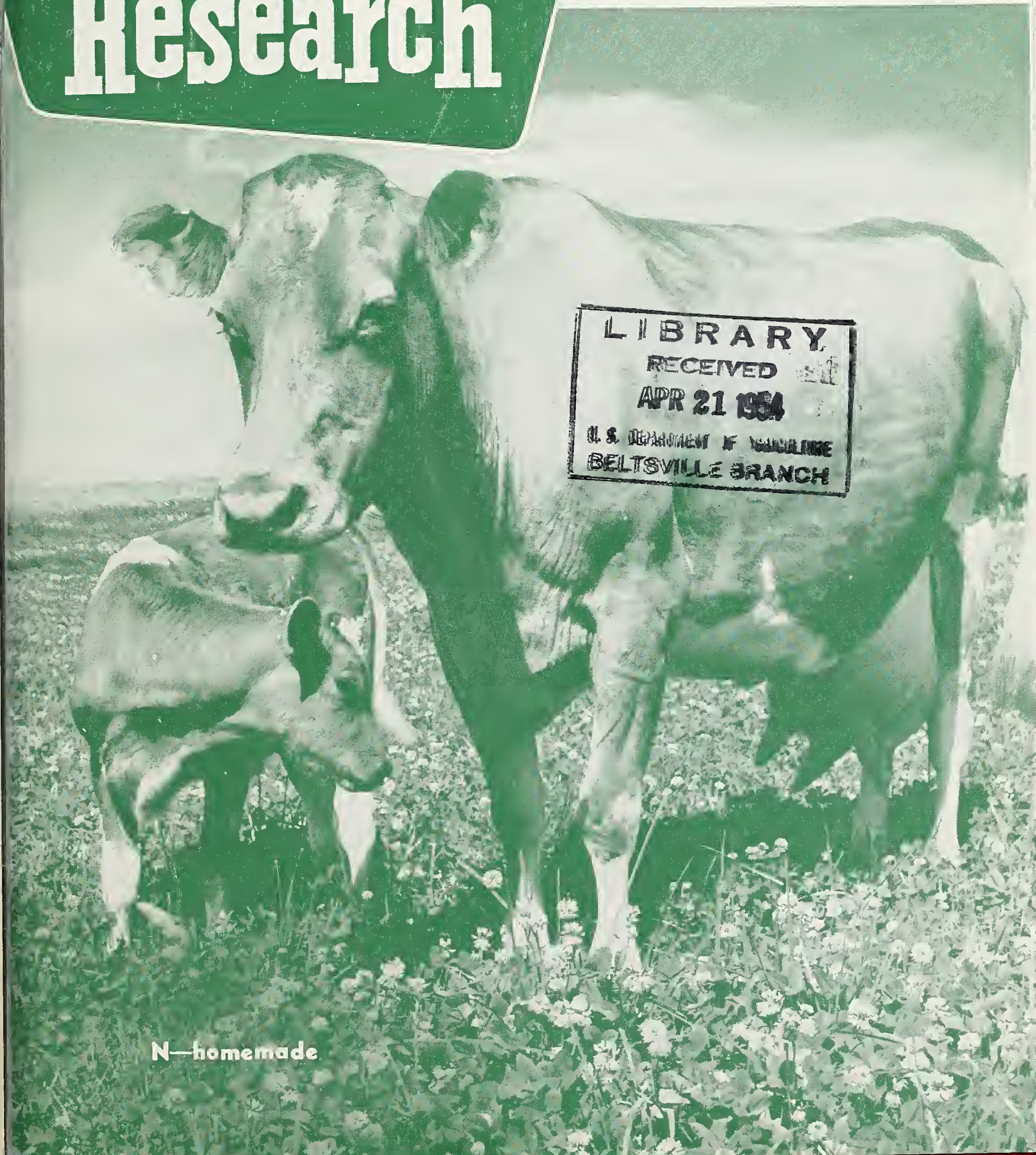
AGRICULTURAL Research

APRIL 1954



N—homemade

AGRICULTURAL Research

VOL. 2—APRIL 1954—NO. 10
JOSEPH F. SILBAUGH—MANAGING EDITOR

What is efficiency?

Efficiency in farming is many things.

It's crops and soils, methods and men. It's planting adapted varieties that make high yields of good products. It's getting the plowing, seeding, and harvesting done on time. It's turning under manure and crop residues to add organic matter and maintain good soil structure. It's applying fertilizers and lime. It's saving the soil from erosion. It's processing and storing products to avoid waste. It's adopting new ways proved to be better than the old.

How shall we measure efficiency in farming?

In the United States, the man-hour yardstick has been much used. That's because labor—rather than land—has been the limiter.

By this measure, our agriculture is the most efficient to be found anywhere. United States farmers used a fourth fewer man-hours in 1953 to get a third more crop production than in 1935–39. Much of this increase has come directly from research in plants, soils, and engineering.

In many countries, labor is plentiful but land is scarce. Here, production per unit area is the common yardstick of efficiency. More labor and less machinery are used, but yields are often higher.

Since there's little new land left in the United States, we must work toward greater returns per unit area and better use of land to meet our increasing needs. Again, research can help gain the objective.

Still another way of measuring efficiency is the yardstick of net returns. Farming has become a high-cost, high-investment business. Machines, fertilizer, insecticides, weed killers and the like made farmers more and more dependent on high returns for their products.

But these very techniques are also helping to lower production costs per unit and to stabilize income by reducing some of the hazards. So farming must be profitable for farmers to be efficient.

If production is to keep up with our growing population, if farmers are to keep up with our economy, we must do two things: (1) constantly improve crops, soil and water management, cultural methods, and equipment; (2) encourage faster adoption of better practices.

To produce efficiently, farmers need the best of knowledge, materials, and techniques. It's the business of research to supply them.

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

LADINO CLOVER, other legumes, can supply grass partners with homemade nitrogen. Or a farmer can buy nitrogen in a bag and apply it to grass. Which way's better? (Story page 6.)

Contents

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Losses in agriculture

Is this Nation's agricultural re-
earch measuring up to the needs of ur growing population and the pos- ibilities of our usable land?

ARS scientists considering this uestion have just brought together ie first comprehensive estimate of sses in agriculture—all the way rom field to kitchen.

This summary covers annual losses rom 1942 to 1951. Wherever possi- le, the scientists used statistical sur- eys and records. If such data weren't vailable, estimates were based on ie judgment of agricultural special- ts most familiar with the types of sses that occur.

The report shows that losses slash early a third from the potential value f our crops, livestock, and forest roducts. The 1942–51 potential ran 41 billion a year—that's actual pro- uction of $27.6 billion, plus $13.4 illion in losses. Soil erosion and oods cut our land value by an addi- onal $1.5 billion a year. Here's how ie losses break down:

Crops. Weather, insects, diseases, iechanical damage, weeds, and har- esting waste are some hazards crops ice. After harvest, there are losses i storage, marketing, and processing; isease and death of animals to which rops are fed; destruction of nutrients i cooking; and waste of edible por- ons of food in the kitchen.

These losses annually equal the po- ntial production on 120 million cres of cropland. That's worth $11.4 illion—33 percent of the potential om our 358 million acres.

Pasture and Range. The many lagues include plant diseases, fire, rasshoppers, and weeds. These cut ie amount of feed and, in turn, the numbers and the weight of livestock.

Losses equal potential production of 154 million acres of such land, valued at $981 million. This is 17 percent of the potential on our full 1,020 million acres. Disease and death of livestock fed on these areas waste an additional $815 million in pasture and range resources.

Forests. Losses are caused by fire, diseases, insects, wind, and mis- cellaneous damage to trees.

This toll equals the potential annual growth from 228 million acres. The value, $285 million, is 47 percent of the potential growth on our 460 mil- lion acres of forest lands.

Soils. Deterioration—mainly ero- sion—and flood damage on croplands, ranges, and watersheds annually amount to $1.5 billion. Some 500,000 acres of cropland are lost to cultiva- tion every year. Furthermore, yields go down and costs go up on the land that remains in use.

All these losses are figured at farm prices that prevailed at the time. This doesn't necessarily mean that farmers' cash income would have increased by that amount if the losses hadn't oc- curred: bigger crops tend to push prices down. But the use of land, labor, equipment, and supplies to pro- duce commodities that are later lost is obviously a serious economic loss— to both the farmer and the general public of the Nation.

Such an evaluation of agricultural losses has long been sought by farm- ers, manufacturers, lawmakers, con- sumers, teachers, scientists. They wanted to know what the problem was. They also wanted to know how well it was being handled by today's re- search programs. Let's see:

You recall that our food, feed, and fiber could have been grown on 120 million fewer acres if all loss had been eliminated. Now, no one expects *full* production—some losses can't be pre- vented. For example bad weather may upset timing on a spray job. The best equipment, pesticides, and seed aren't always available. Or a practice may not pay under some economic conditions.

But many savings could be made with the knowledge now available.

It's estimated that we could reduce losses from disease by 75 percent in cotton, 50 percent in apples and pota- toes, 29 percent in tobacco, and 23 percent in wheat.

Insecticides could save 30 percent of the losses in livestock weight gain and milk production. Known control measures could reduce poultry coccid- iosis losses by 90 percent. Brucel- losis in cattle, swine, and goats could be completely eradicated.

It's apparent, however, that we need more information to attack many agricultural losses. To reduce them substantially, we must carry on much more research to develop ways of growing more products at lower unit costs and of cutting waste and spoil- age in handling, marketing, and dis- tribution. We must also inform farmers of new findings so that im- proved practices will be adopted.

Over a period of years, land and other resources can be released as losses are brought under control. These resources will then become available to supply an increased pop- ulation with agricultural products.

(Details are given in "A Report of Losses in Agriculture," to be ready for distribution this month.) ☆

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WHEN corn needs water

Moisture supply during ear and kernel formation—rather than the total seasonal supply—makes the big difference in corn yield.

Irrigation studies at Scotts Bluff, Nebr., by ARS and the Nebraska experiment station showed this. The best-timed irrigations—7 inches of water in 3 weekly applications started just before tasseling—produced 144 bushels per acre, just 9 bushels less than 14 inches in 6 irrigations. But 3 irrigations completed prior to the tasseling stage used water only three-fourths as efficiently as the 3 best-timed applications.

Yields generally increased with the number of irrigations, but the production of grain per inch of water increased only to the second or third irrigation and declined sharply with additional ones.

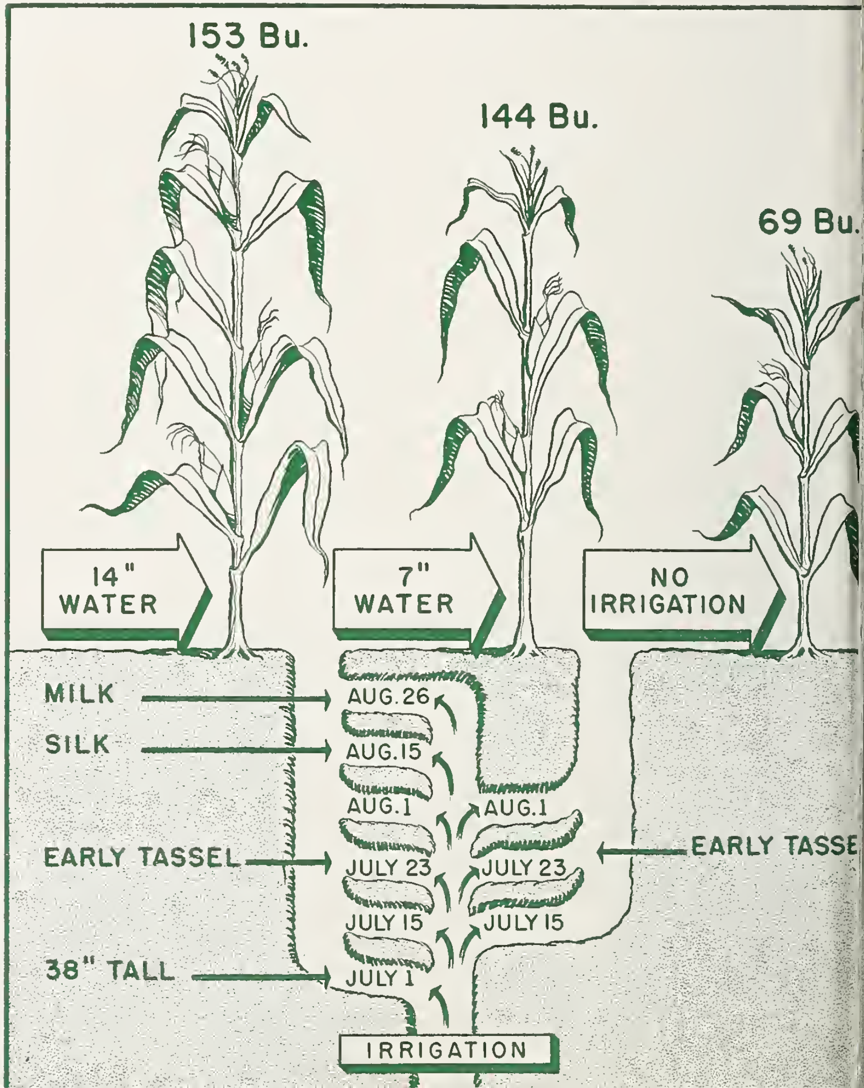
The experimenters, O. W. Howe and H. F. Rhoades, say most farmers in the irrigation-corn country can increase their corn yields by timing irrigations better. They may save water, too. It seems best to start the season with a large balance of soil moisture and add more before the critical need for water arises. Need is greatest at tasseling and silking.

In tests started with well-watered soil, irrigation much before tasseling didn't get top results. Delaying irrigation until advanced-tasseling cut yields 35 bushels per acre. Irrigation after silking helped little, after milk stage, none. This emphasizes the critical need for water when tassels and silks are forming.

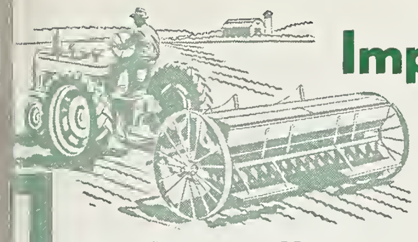
The three best-timed irrigations produced 144 bushels per acre, or 9.2 bushels per inch of water. Unirrigated plots yielded 69 bushels—only 6.7 bushels per inch of water.

Corn can reach wide and deep for water. If ground moisture is ample at planting and peak needs are met by timely irrigations, corn will draw heavily on ground moisture to finish the job. To see how far roots go and how important it is to put back the water taken out by the crop, Howe and Rhoades tested soil moisture periodically at various depths.

Where the corn started with ample moisture in the top 6 feet and had 6 irrigations, it drew 93 percent of its total water from the top 30 inches. But nonirrigated corn got only 43 percent of its water from the top 30 inches and 57 percent of it from greater depth. Corn on the other plots with various moisture treatments ranged between these extremes—the less the irrigation applied, the deeper the reach of the roots for water.☆



Improving our RANGES



1 by Reseeding

Poor crop land reseeded to nutritious grasses is yielding 2 or 3 times as much beef per acre as native range at USDA's Southern Great Plains Field Station, Woodward, Okla.

Well-adapted grasses, an effective seeding plan, and subsequent weed control are given credit for the economical restoration of this typical southern-plains range.

The most successful plan in the Woodward trials was started several months before grass-seeding, says ARS range ecologist E. H. McElvain. A preparatory crop of sorghum was close-drilled about July 1. The sorghum was grazed or cut for hay, largely paying for reseeding. The grasses were seeded early the following spring on the firm seedbed of the stubble field—protected by the undisturbed sorghum stubble.

Several grass mixtures were tested. One combination stood out as best adapted to the varying soil and climate in the southern-plains area, most dependable for season-long production, and most likely to provide a well-balanced diet through the year.

Two pounds each of the reliable blue grama and side-oats grama are the basis of this mixture. It includes 1 pound of cool-weather-loving western wheatgrass for spring and fall grazing, 1 pound of nutritious yellow sweetclover, and 1 pound of productive switchgrass (half as much of the latter where soils are sandy). Two pounds of mixed bluestems and ½ pound of sand lovegrass are a valuable addition for sandy soils. On heavy soils, make it 1 pound of buffalo grass instead.

This takes care of 1 acre, with good seed that germinates well.

To compare the value of individual grasses used in the mixtures, scientists tried the recommended grasses alone on soils to which they're adapted. Sand lovegrass was the leader over an 8-year period of comparison.

One of the better experimental mixtures—blue grama, side-oats grama, western wheatgrass, and Texas bluegrass—yielded an average profit of $7.68 in beef gain per acre. Although sand lovegrass alone was more profitable during part of the season, it failed to provide the sustained grazing of the mixture. Well-managed native range returned a profit of $4.15 in beef gain per acre.

Buffalo grass was included in the mixture for heavy soils. Alone, however, it failed to live up to its fame for forage and beef production.

2 by Debrushing

Sand sagebrush—a costly range weed—has been profitably controlled at the Southern Great Plains Field Station. Cooperative tests with the Oklahoma experiment station show that either mowing the range or spraying with 2,4-D can do a lasting job.

These methods killed three-fourths of the brush. They gave desirable grasses a chance to increase about threefold and provided relatively sage-free grazing for 10 years, with more good grazing yet to come.

Extra grazing in one year paid the total cost of chemical control. Ecologist E. H. McIlvain and economist W. F. Lagrone say even the costlier mowing returned a good profit.

Mowed range had only 19 percent as much sand sagebrush as untreated range at the end of 10 years of test-grazing. This much brush is needed for soil protection and for browse in late winter and early spring.

All the early Woodward tests involved mowing, but the herbicide seems to be just as effective, or more so. It also killed other troublesome weeds—skunkbrush, perennial broomweed, and golden aster.

Heavily brushed range needs only one 2,4-D treatment. The spray can be applied for about $2.50 per acre.

By the mechanical method, the first mowing is done in June. This cost about $3 per acre at Woodward. A followup mowing 1 year later—somewhat lighter work—is less expensive.

Improved range averaged $2.57 more annual grazing profit per acre than unimproved range when both were summer-grazed. This edge was $3.18 per acre for yearlong grazing.

The best spray was found to be 1 pound (acid equivalent) of 2,4-D in 3 gallons of diesel oil or in an emulsion of 1 gallon of the oil and 2 gallons of water. Spraying is effective only when the brush is full-leafed and lush—between May 1 and June 10, depending on latitude and earliness of the season. April–May rainfall and temperature must have been normal or higher, growth rapid.

Spraying is faster than mowing—an important consideration since the short time for effective treatment falls at a busy season.

Both methods require resting the range till fall following treatment, and moderate grazing from then on. Abusive grazing damages cleared range more than sagebrush range.☆

N— buy it or grow it?

Big yields of high-protein forage take plenty of nitrogen.

Can this needed nitrogen best be supplied by using fertilizers on pure grass stands or by growing grasses along with legumes?

Generally, grass-legume mixtures are considered to have advantages. Inoculated legumes make their own nitrogen, supply it to the companion grasses. Legumes tend to increase both yield and quality of forage.

On the other hand, fertilizer is giving favorable results on pastures under a variety of conditions.

One comparison comes from ARS trials at Tifton, Ga., in cooperation with Georgia Coastal Plain Experiment Station. Louisiana white, Dixie crimson, and subterranean clovers with Coastal Bermuda made as much forage as Coastal alone but with 100 pounds of applied nitrogen.

The point is sometimes made—and there are data to support it—that nitrogen-fertilized grass won't produce as much gain as legume-grass mixtures. One series of tests won't settle the question, but trials at Tifton are showing good responses in beef cattle from nitrogen fertilization of Coastal Bermuda grass.

All pastures in the Tifton experiments get 500 pounds of 4–8–6 fertilizer every other year, with an annual top dressing of nitrogen at varying rates. On pasture receiving no nitrogen, the average annual live-weight gain per acre for two seasons has been only 262 pounds. With 50 pounds of nitrogen, the gain has averaged 315 pounds; with 100 pounds of nitrogen, 496 pounds; and with 200 pounds of nitrogen, liveweight gain went up to 691 pounds per acre.

At Northern Great Plains Field Station, Mandan, N. Dak., recent studies also suggest that grass-legume mixtures provide more dependable pasture than can be expected from grass alone. Mixed grass and alfalfa produced 1,006 pounds of total digestible nutrients per acre in 1952, compared with 460 pounds from crested wheatgrass alone, 496 from Sudan grass, 271 from native grass.

It's significant that 90 pounds of nitrogen annually on sown pastures at Mandan increased production 450 percent for crested wheatgrass, 518 percent for bromegrass, and 1,065 percent for Russian wildrye.

Lately, interest has gained in growing grasses in pure stands with heavy application of nitrogen. Farmers say legumes in mixed seedings are hard to maintain. Increasing incidence of livestock bloat on legume-grass pastures also has caused some to favor pure grass. And greater availability of nitrogen fertilizers at the present time makes it possible not only to get high yields but also to improve the quality of the grass forage.

ARS scientists at Beltsville, Md., compared two mixed seedings—orchardgrass and Ladino clover, and tall fescue and Ladino clover—with pure grasses fertilized with nitrogen at various rates. In general, the legumes with grasses fixed around 150 pounds per acre of utilizable nitrogen a year. This equals more than 750 pounds of ammonium sulfate.

Improved production and quality of forage are apparent from the results shown in the chart. They suggest that at least under some conditions adapted grasses will use high proportions of applied nitrogen and produce yields of protein that compare favorably with those from grass-legume mixtures.☆

RICHER MIXED FERTILIZERS ARE *in the bag*

The richer fertilizer mix that farmers want—a total of 30 pounds or more of plant food, at least one-third nitrogen, per 100 pounds—has been "too big for the bag" without using concentrated superphosphate.

Recent developments, however, have raised the practical ceiling above the 26-percent level of total nutrients for smaller manufacturers of moderately priced complete fertilizers. This foreshadows richer mixes—above the commonly available 20 to 24 percent—in abundance soon.

ARS and TVA scientists, working cooperatively, have found an economical way to squeeze some of the useless poundage out of one of the ingredients, superphosphate. They've made an enriched super with 20 pounds of phosphorus pentoxide (P_2O_5) in 65 to 70 pounds of material, compared with the usual 20 in 100. Supplying the required P_2O_5 in less super makes room in the formula for more nitrogen (N) and potash (K_2O).

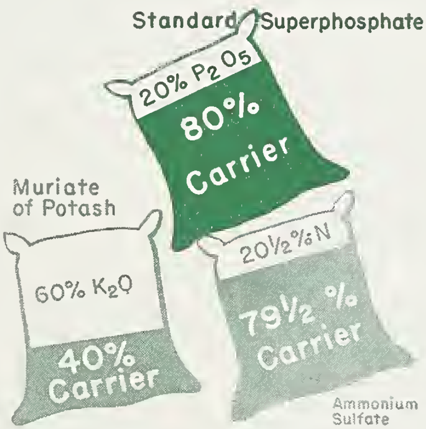
Fertilizer researchers E. J. Fox and R. M. Magness demonstrated in the ARS laboratory that they can blend sulfuric and phosphoric acids to treat phosphate rock and make an enriched super—28 to 30 or even 35 percent. TVA's L. D. Yates and F. T. Nielsson demonstrated in the pilot plant that the mixed-acid treatment is practical in present super plants of any size.

In the oldest process—which is economical, easily managed, and therefore most commonly used—sulfuric acid is diluted with water, cooled, and applied to phosphate rock to produce ordinary 20-percent super.

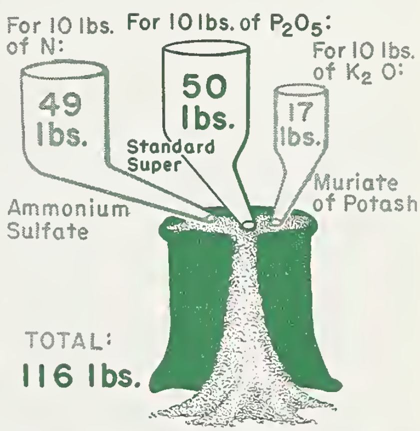
In another process, commercial-grade phosphoric acid is heated to boil off excess water, cooled, and applied to the rock. This produces triple super testing about 48 percent. Both acid and rock contribute phosphorus. The process is difficult, takes special equipment formerly found only in large plants, and costs more per pound of P_2O_5 produced.

In the mixed-acid treatment, the two acids previously used separately are now combined. The process is just about as simple as the prevailing sulfuric-acid method and can be operated in the same equipment. It permits production, in a single step, of a phosphate with the same nutrient level as separate manufacturing and blending of low- and high-grade super. Even the need to concentrate one acid and dilute the other has been resolved by mixing them. One's excess moisture meets the other's need for more.

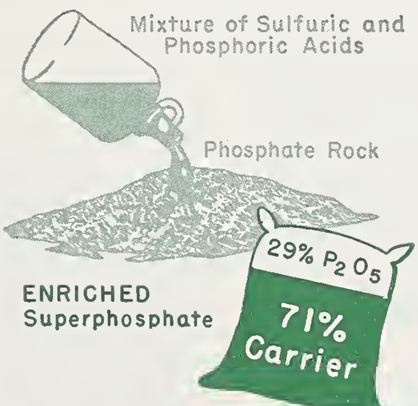
The phosphate producer can now make his needed phosphoric acid in a small auxiliary plant and may recover some valuable byproducts.☆



INGREDIENTS of a complete fertilizer vary greatly in nutrients. The analysis is low in the common and economical phoshorus and nitrogen materials illustrated above.



ATTEMPTS to make a 10–10–10 from the ingredients at the left would result in a mixture "too big for the bag." Formulawise (per 100 lbs.) it's actually an 8.6–8.6–8.6.



THIS ENRICHED super can be made simply by a new process using a mixture of 53 lbs. phosphoric acid and 47 lbs. sulfuric acid in treatment of 100 lbs. of phosphate rock.

LOW-COST 10–10–10 mixes, now a perfect fit for the 100-lb. bag, can be made economically. Supers having up to 35 percent P_2O_5 are possible—would make richer mixes.

the snow men

MOUNTAIN SNOW PACKS like this each winter store the water on which the West largely depends for its irrigation, hydroelectric power, municipal and other essential uses. About 875 men have traveled an estimated 41,000 miles this winter alone to measure the snow for its water content on 1,180 snow courses in 11 States and British Columbia. Their reports are the basis for forecasts of water supply.

A WATER-SUPPLY FORECAST this month will tell 17 western States how much irrigation they can count on for next season. And farmers will be glad the scientific snow men have been at work.

The forecast will reflect snow samples taken by an army of hardy men who travel each winter high into the mountains, to remote places where the snow lies as much as 20 feet deep. Last winter they covered 41,000 miles by skis and snowshoes, oversnow machines, and aircraft.

Whose army? It's employees of the Soil Conservation Service, Forest Service, State experiment stations, State engineers, municipalities, flood-control agencies, water-users' associations, power companies, and other public and private interests. SCS coordinates and develops the forecasts, and the Weather Bureau cooperates in giving the information to water users.

Snow samples are gathered at many stations—always the same ones—time after time, year after year. A core of snow is taken with the sampling tube, thrust all the way through to the soil. But depth alone is no accurate indicator of the potential water there. Winter storms build up layers of snow of varying density. Snow is a mixture of air and water, and it's the water that counts.

Aircraft are used to carry snow men to some remote or more inaccessible courses, and are coming into use for less significant early-season reports. A low-flying pilot reckons snow depth by counting the crossbars on steel pipes protruding above the snow. Then a surveyor takes density samples nearer the highways.

Soil moisture under the snow, along with temperature and rainfall, is one of the factors that determine how much of the snow melt will run off, and how fast.

Snow men call this the "soil priming" factor—as you prime a pump. It is so important that the California Forest and Range Experiment Station some years ago developed a system of measuring undersnow soil moisture. SCS has adopted this system. Tiny fiberglas blocks are

MECHANIZED equipment enables fewer men to cover more terrain at little added cost. Though snowshoe and ski surveying predominates, SCS and cooperating agencies use about 45 oversnow machines. Contract aircraft are being used to measure snow depth in seven States.

SNOW COURSES are permanently marked in major storm paths on sheltered mountain meadows. Sectional sampling tubes are assembled to the required length. Depth is read from slits in side of tube, and recorded.

TUBE IS WEIGHED, first empty and then filled, on a special hand scale that translates the snow weight into inches of water. Ski poles serve as a tripod hanger. Note the circular, sawtooth ice cutter at bottom of the tube (right of picture), driving wrench at the other end.

buried in the soil at 1-foot intervals down to bedrock. Wires from the block lead out through a standpipe. The surveyor passes an electric current through the block. An ohmmeter reading shows the block's resistance to the current—the wetter the block, the higher the resistance.

With the aid of tables, electrical resistance can be translated into terms of the moisture content of the soil and its capacity for taking in more moisture. That, in turn. helps scientists forecast the snow-melt runoff.

In planning 1954 crops according to the forecast, farmers will be paying tribute to the forecasters' ever-increasing dependability. Figures for the entire Columbia River Basin in 1953 averaged 90 percent accurate. Predictions are often within 3 to 5 percent of the season's actual water flow. This is a record made despite uncertain late-season snow and rainfall, unusual melting conditions, and variable moisture in watershed soils.

SCS snow-survey engineers are pushing ahead with studies on measuring and forecasting techniques. Morphology observations are being made into the pattern and behavior of snow and snow water. The engineers are studying the influence of such matters as wind and melt. And they are continuing the search for the best correlations of sample data with other factors that foretell how much water will flow onto farmers' fields.

This systematic effort makes snow surveying a science—niphometeorology—that yearly gains in precision.☆

STREAMFLOW and reservoir storage prospects for summer users show up in April surveys, when snow is deepest. Monthly surveys starting about November, however, give advance indications. And May surveys show the effect of melting rate on the water supply.

88 BILLION GALLONS of water a day are used for irrigation, mostly in western States. Advance water-supply information enables farmers to plan their crops for best use of water—to counter with water-saving practices when a shortage is in prospect.

Froth flotation

saves time and produce

There may not seem to be much connection between preparing ore for the smelter and peas for the canner.

But froth-flotation—first used by the mining industry for concentrating ores—is now removing debris from green peas, corn, lima beans, black-eyed peas, soy beans and sprouts, blueberries, cranberries, sweetpea seed, pecans, and walnuts.

As developed by the ARS Fruit and Vegetable Products Laboratory at Prosser, Wash., this process has become a valuable tool for commercial canners and freezers. It cuts out three-fourths of the labor in removing foreign matter, saves large tonnages that would otherwise be discarded because of contamination, and improves the quality of the product.

The problem began in the pea industry. Canners couldn't remove berries of nightshade—common pea-field weed—from shelled peas.

Mechanical shakers and screens would get rid of coarse trash and sift out fine weed seeds, but the nightshade berries were almost exactly the same size and color as peas. Worse yet, they had about the same specific gravity. This meant they couldn't be separated by running the mixture into a tank of brine to allow one to float and the other to sink.

The Prosser laboratory finally found the answer, based on the fact that the berries had a waxy coating. The peas were more "wettable." Researchers devised a method of treating mixed peas and berries with an emulsion of air, oil, water, and a detergent — sodium lauryl sulfate. Tiny air bubbles, dispersed through the emulsion by a circulating pump, provide a froth that helps to float out the contaminating substances.

Treated peas sink. The berries—wetted less easily—are buoyed up by the froth bubbles and float to the surface where they are skimmed out with the foam. Froth-flotation also takes out injured peas, bits of skin, and other foreign matter.

Suitable equipment for operating the froth-flotation process on a commercial scale was developed at the

This may be another job for 2,4–D: Banana

Produce men have long hoped for a safe, simple method of banana ripening to take the place of the hazardous ethylene gas chamber.

ARS scientists now believe the common plant regulator and weed killer 2,4 - D (2,4 - dichlorophenoxyacetic acid) offers promise as a ripener to take the place of ethylene.

At the Plant Industry Station, P. C. Marth and J. W. Mitchell tried two methods of treating bananas in the green shipping stage: (1) a spray or dip of 250 to 500 parts of 2,4-D per million parts of water; (2) 2,4-D in an aerosol bomb, like that used for applying insecticides.

Bananas treated either way ripen 3 to 8 days earlier than fruit ripened naturally in the presence of the gases (mostly ethylene) given off by the bananas themselves. The 2,4-D-ripened fruits are more uniform in color and noticeably sweeter. Furthermore, by treating part of a shipment at a time, produce dealers could regulate the ripening of their bananas according to the market demand.

A critical point in the new treatment is that neither ethylene gas nor the natural gases from ripening bananas gets along with 2,4-D. Its favorable effects are stymied by these gases if they're allowed to remain in the storage space, so the room should be well ventilated. Spraying a mist of water into the room may be necessary to prevent the bananas from losing moisture under these conditions.

IN 4 DAYS, 2,4-D-sprayed bananas (right) had ripened far ahead of the untreated fruit.

Prosser laboratory. Scientists there also devised a regulator that automatically controls the wetting properties of the solution used.

Greatest labor-saving potential of this technique is in cleaning blanched or raw whole-kernel corn. Canners have a problem of trimming off kernels injured by corn borers and earworms. A modified flotation process promises excellent results by carrying insects away in the froth along with bits of husk, silk, and injured kernels. Besides, the sweet corn can make its own froth.

More than 230 million pounds of peas were cleaned in 1953 with the 135 flotation units operating in the United States. Six units are in use abroad and 20 more are under construction by a food-equipment maker. In addition, 50 units are being used to clean lima beans, 20 for cut corn, and 5 for black-eyed peas.☆

Ripener

Marth and Mitchell found aerosol-applied 2,4-D highly satisfactory on a small scale. They used the ester form, mixing it with the refrigeration gas freon. This disperses the ripener in a fine mist. But the pressure-spread plant regulator is too penetrating and drifts too readily to be used near growing plants—for example, nurseries, gardens, or greenhouses.

Much of the flavor difference in bananas colored and ripened by 2,-4-D probably comes from a change in sugar content. With a treatment lasting 4 to 8 days, sugar raised from less than 1 percent to 10 to 20 percent. Slow, natural ripening brought sugar up to only 7 or 8 cents.

Similar but less pronounced ripening has been noted with 2,4-D sprays on apples, pears, and other fruits. So far, such a method has not been developed commercially.☆

Better frozen foods with WAXY-RICE FLOUR

An old oriental cooking trick has solved a problem of the precooked-frozen-food industry.

Sauces, gravies, and puddings often looked curdled after thawing, and liquid had a tendency to separate. Scientists of the Western Regional Research Laboratory at Albany, Calif., overcame this instability by using flour from waxy or glutinous rice, which was formerly found only in oriental ceremonial foods.

Many housewives had become discouraged with some precooked frozen foods. Those containing sauces made with ordinary flour took so much stirring to reduce the curdled appearance that the meat and vegetables became mushy and unappetizing.

Puddings and custards were no better. Similarly, cake fillings thickened with eggs and ordinary flour or starch couldn't be successfully frozen because the liquid from such a filling soaked into the cake after thawing. Filling in cream pies thickened with egg and starch became grainy and showed liquid separation.

Early workers disagreed about the principal cause of this texture instability. Each ingredient—liquid, fat, thickening agent, and the rest—was studied. ARS researchers found that several of these ingredients can alter sauce stability.

Homogenizing and use of stabilizers or emulsifiers were tried. But the best solution seems to be flour made from waxy rice, which can be grown domestically. Flour from other waxy cereals is better than ordinary flour for this purpose, but not as good as waxy-rice flour.

Sauces made with this flour may show some liquid separation after long storage at a relatively high temperature of 10° F. or above. But they soon become as smooth as sauces that have never been frozen.

Waxy-rice flour has been substituted for cornstarch and gelatin in the corn-starch-pudding type of dessert. Such puddings don't change in appearance, even after 6 to 9 months at 0° F. In the custard desserts, part of the egg has been replaced with this flour. The custards now are stable for as long as 2 to 4 months.

Several mills are producing waxy-rice flour today, and at least 50 commercial concerns are using it. In addition, the Food and Container Institute for the Armed Forces has included waxy-rice flour in specifications for a number of items bought by the Quartermaster Corps.☆

Growers can cut *Turkey Diseases*

TURKEY DISEASE losses, which cost growers $17,000,000 a year, can be cut substantially by ounce-of-prevention methods.

ARS poultry pathologist J. E. Williams says turkey growers should follow these five general practices to guard against disease in their flocks: (1) buy poults from a reputable hatchery; (2) use sound management; (3) follow a good feeding program; (4) practice strict sanitation; and (5) watch the flock constantly.

Williams also recommends that growers use diagnostic services now available in many States, if they suspect a disease outbreak. With a few live birds to examine, knowledge of early symptoms, mortality, rate of onset, treatment, feed, and other factors, laboratory workers can often check a dangerous infection.

Salmonella infections, such as pullorum, typhoid, and paratyphoid, and the paracolon infections are high on the list of diseases that concern turkey growers. Vigilance and sanitation keep these diseases away.

Symptoms and post-mortem lesions in both groups are similar. All may be egg-borne, and diagnosis takes laboratory tests. Typhoid carriers may be detected by pullorum tests, as may some carriers of paratyphoid and paracolon infection (testing for the latter is limited). They occur widely in nature, but pullorum and typhoid carriers are usually found only in chickens and a few other fowl.

Control begins with the purchase of disease-free stock. When infection is found, however, general blood-testing should be undertaken and reactors removed. Frequently, paratyphoid-infected flocks should be destroyed. Treatments aren't entirely satisfactory. Losses may be cut by sulfa drugs, but results indicate a need for some further study.

Blackhead is an old disease of turkeys and long the bane of growers. Caused by a parasitic organism that thrives in the intestinal tract, blackhead spreads from bird to bird through droppings. It was originally a disease of chickens, which have developed fair resistance but are still carriers. Parasite eggs may survive for years in cecal worms or cecal-worm eggs of the chicken, and no known chemical kills the eggs in soil once a range is contaminated.

Because turkeys are so susceptible to blackhead, they should never be raised with chickens. Control is best achieved by range rotation. Phenothiazine ($\frac{1}{2}$ gram per poult, 1 gram per adult) eliminates adult cecal worms from turkeys and chickens.

When blackhead is a constant problem, a grower should consider continuous use of drug preparations that retard this disease. Close watch should be kept to see that water consumption stays up to normal.

Coccidiosis, trichomoniasis, and hexamitiosis are found frequently in certain parts of the country. Like blackhead, these are caused by parasites and may be prevented and treated in much the same way.

Bluecomb, cause of which is still unknown, appeared in Minnesota turkeys in 1951. It's also called mud fever, nonspecific enteritis, and pullet disease. Research at the University of Minnesota indicates the disease may be contagious.

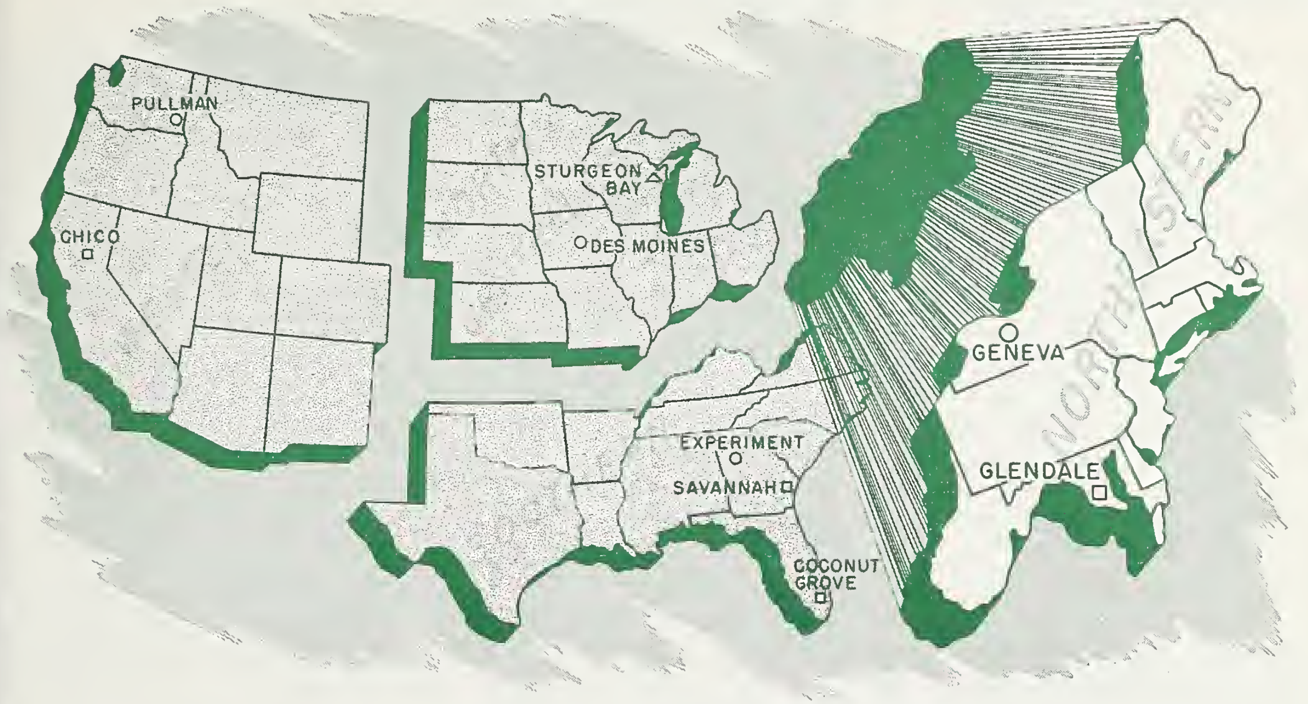
Bluecomb appears in both acute and chronic forms. The former causes losses that continue for about 10 days after affected birds stop eating and drinking and develop a diarrhea. Heads and flesh turn dark blue. In the chronic forms, symptoms don't appear so early and there's less drop in feed and water intake.

Since there are no thoroughly tested treatments, preventive measures are still the best means of control. Encouraging results have been obtained in infected flocks, however, by use of molasses at the rate of 1 pound to 5 or 6 gallons of water, and Epsom salts at the rate of 1 pound to 4 or 5 gallons of water. The medicated water is used a half-day, then plenty of fresh water is provided.

Erysipelas, a bacterial disease of turkeys, for the most part affects market-age birds, especially males. Toms are affected more than hens because skin injuries from fighting allow the organisms to get in.

Debeaking and desnooding may help prevent erysipelas, but these practices need considerable field testing before they can be recommended. Two satisfactory methods of treatment are the use of penicillin and erysipelas antiserum. Vaccination results are fairly encouraging, but little is known about its duration. This treatment should be done before there's any evidence of the disease.

Infectious sinusitis, a respiratory infection, is caused by a virus-like agent strongly suspected of being the same that causes the still mysterious airsac of chickens. In turkeys, symptoms include nasal discharge, swollen sinuses, labored breathing, and coughing. Streptomycin and other antibiotics are used to treat this disease and its respiratory forms.☆



○ Regional Plant Introduction Stations (cooperative between States and ARS)
△ Interregional Potato Introduction Station
□ Federal Plant Introduction Stations for special long-term projects

Plant bank for the Northeast

The Northeastern Regional Plant Introduction Station has opened at Geneva, N. Y., completing a group of plant banks set up to serve the country's four main sections.

Part of an ever-growing supply of imported and domestic germ plasm collected for plant breeding will be handled at the Northeastern station. This places potentially useful experimental materials closer to the Nation's scientists, who use them in creating new and better varieties and strains (Agr. Res., July 1953).

Several crops commercially important in the Northeast have been assigned to the new Geneva station. These include timothy, orchardgrass, red clover, eggplant, and most celery. Other crop materials are similarly distributed among regional introduction stations at Experiment, Ga., Ames, Iowa, and Pullman, Wash. All four of the regional stations are cooperatively operated by ARS and the State experiment stations.

More than 5,000 plant materials previously banked at the United States Plant Introduction Station at Glendale, Md., have been turned over to the new Geneva station. It will also have access to materials assigned elsewhere—some of them may ultimately be reassigned to Geneva—but naturally will work most with the regionally important forage crops, truck crops, and fruits.

Ten State experiment stations in the Northeast are already evaluating plants from the Geneva collection. Some are also collecting and revaluing strains, varieties, and species of local plants—beans, grasses, clovers, and small fruits, to mention a few—in search of overlooked genetic values. Screening reports and experimental stocks of the better plants will go out through the new Geneva station and associated research committees to the many plant breeders and scientists throughout the country.

D. D. Dolan, a horticulturist, has been appointed regional coordinator in charge of the new station. The program is directed by a committee headed by A. F. Yeager, of the New Hampshire experiment station. A. J. Heinicke, of the New York experiment station, at Geneva, is administrative advisor to the new station.☆

Easy does it in these Feedlots

Time is money, and many farmers fattening beef cattle are losing a lot of time doing feedlot chores.

In Illinois, for example, farmers average 10 to 12 manhours feeding and caring for each animal they send to market. Most of the work is done by hand. But many Illinois farmers do a good job in far less time.

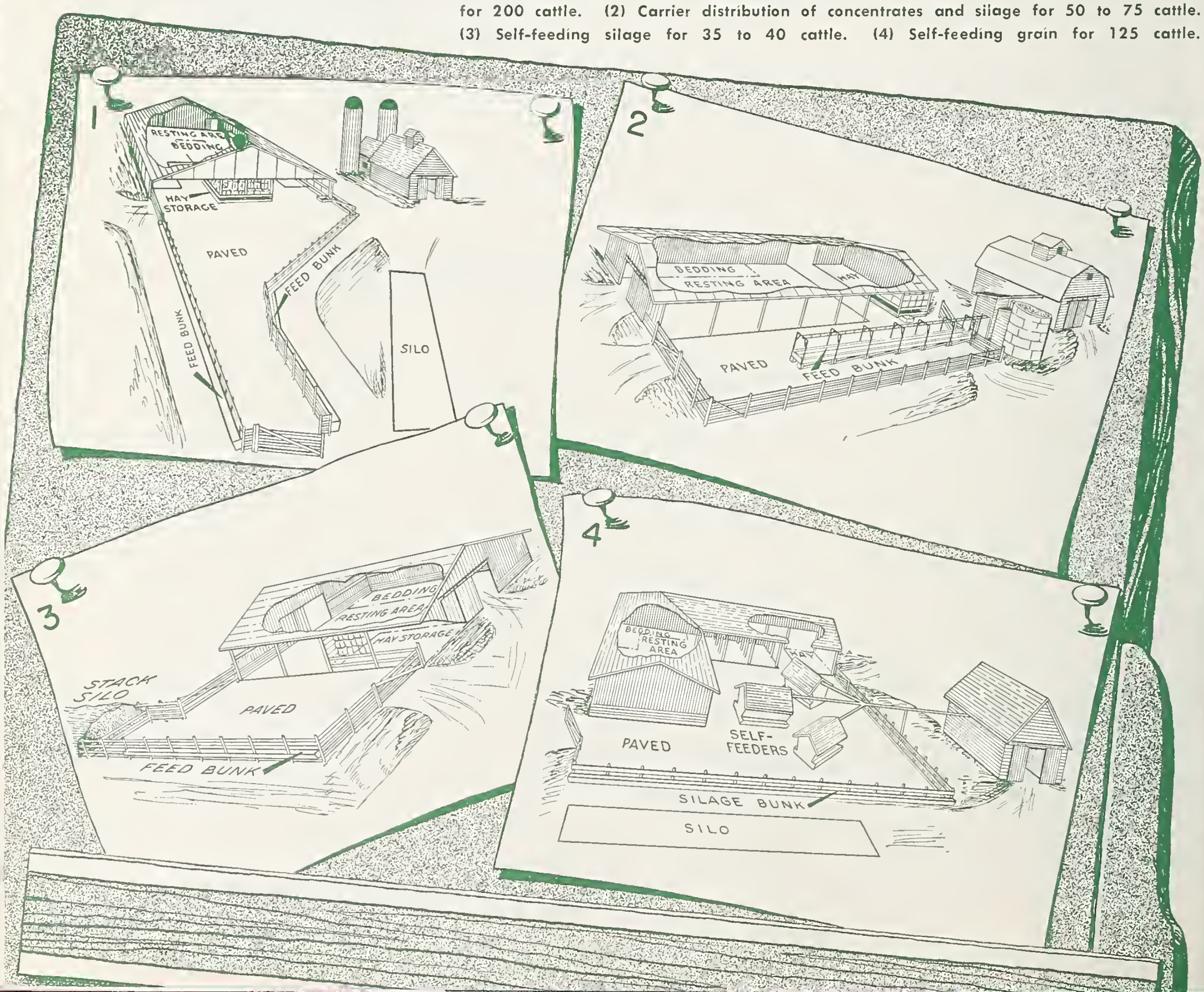
ARS economist R. N. Van Arsdall and agricultural engineer Thayer Cleaver, in cooperation with the Illinois experiment station, set out to find labor-saving ways of feeding beef animals. The researchers studied 36 farms in the northern part of the State and also observed feeding operations on some 60 other farms.

The main job is handling silage. It often makes up three-fourths of the total feed weight. Furthermore, most farmers move concentrates about the same way as silage and generally use the same equipment for the job.

Van Arsdall and Cleaver found that taking the backache out of feedlot chores can also increase efficiency. On some farms this may be a matter of a few changes in using equipment already on hand. On other farms, it may be a major operation—rearranging buildings, remodeling or adding to storage and handling facilities, buying some power equipment.

Four plans were worked out for different-sized herds. The plans are

FASTER, EASIER feeding is built into these plans: (1) Wagon distribution of silage and grain for 200 cattle. (2) Carrier distribution of concentrates and silage for 50 to 75 cattle. (3) Self-feeding silage for 35 to 40 cattle. (4) Self-feeding grain for 125 cattle.



based on the most practical and efficient setups studied, plus refinements added through experiments.

Probably no one plan will fit any one farm. The answer depends on what's already there, how the herd is fed and managed, the balance between investment and labor expense.

The researchers also have these general suggestions for feeders:

1. Build one-story barns and sheds, rectangular or **L**-shaped. Enclose three sides, leave all or most of one side open to South or East.

2. Store hay inside at ground level so it can be moved directly into sheltered racks, or so movable racks can be used for self-feeding. Store it near the open side of the barn to reduce trampling of bedding, or in a shelter in the lot. Store straw in back of barn, where it's used.

3. Place grain and supplement feeding devices outside—not in limited barn space where manure accumulates and feeding must be done by hand. Weather-tight self-feeders can be kept in lot. For basket, cart, or carrier feeding, use standard open bunks in lot. Use fence bunks for wagon or power-scoop feeding.

4. Provide 30 to 35 square feet of barn space for each animal, not counting hay and straw storage. Allow about the same in feedlots.

5. Pave the feedlot and feeding areas. Use gravel or crushed rock to get an all-weather surface on travel routes outside the feedlot.

6. Build 20 to 22 inches of bunk space for each animal, if all cattle are to be fed at one time. To do this and still keep down size of feedlot, build it **L**- or **U**-shaped. Some farmers allow 3 to 6 inches per head in large fence bunks and keep feed before cattle all the time, as in self-feeding.

Details have been published in Circular 714, "Handling Silage and Concentrates for Beef Cattle in Drylot," by the University of Illinois College of Agriculture, Urbana.☆

DAIRY

Use with care: THYROPROTEIN

More profitable methods of using thyroprotein, a synthetic hormone fed to dairy cows to increase milk production, may come out of research begun recently by ARS scientists.

Thyroprotein has been available to dairymen for several years in commercial feed concentrates. Like the secretion of the thyroid gland, it steps up the rate at which the body burns food. Thus it theoretically increases milk and butterfat production in a cow, much as a forced draft makes a fire burn faster.

Experimental use by ARS dairy researchers in the past has shown that proper quantities of this product for 1 to 2 months during lactation will increase milk flow in some cows as much as 20 percent. Used this way, it gives the dairyman the advantage of stepped-up production at the most profitable seasons. But the chemical has many disadvantages, and extended use over entire lactation periods may have some harmful effects.

Further studies are underway in ARS. Previous work has shown that cows fed the hormone in proper amounts for short periods usually give more milk, but their production falls sharply and sometimes practically ceases when the thyroprotein is taken away. The scientists hope to find a method of tapering off these production decreases. Various State experiment stations have done work on gradually reducing the thyroprotein after a 2-month period of normal use, but the results aren't conclusive.

Long-term use of the chemical has not been encouraged by ARS scientists, nor have results of research in this country and England indicated an advantage in feeding the hormone for extended periods. It hasn't paid off—either in increased production of milk and butterfat for the whole lactation period or in returns above feed costs.

Research gives no indication that long-term feeding of the hormone (200 to 300 days of successive lactations) is injurious to the general health of cows. Mortality in calves from these cows, however, was about three times greater than death loss in calves from cows that didn't get thyroprotein. Normal death losses occurred in calves from cows fed thyroprotein for short periods.

Tests also indicate it's not advisable to feed the hormone in either the early or very late stages of lactation. Other findings show that:

1. Cows shouldn't be started on thyroprotein in hot weather.

2. Cows in second or later lactations respond with greater milk yields than heifers in first lactations.

3. Starting thyroprotein treatments after 100 days of lactation will probably give the best results.

4. High-producing cows respond better than low-producing cows.

5. Extra feed should be supplied during the entire treatment period to maintain body weight and general appearance, and to help sustain the increased milk and fat production.

6. Because of the large variation in response, thyroprotein should be fed on an individual-cow basis rather than to every animal in a herd.

7. Until researchers work out a better method, thyroprotein should be tapered off gradually.☆

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AGRISEARCH Notes

Killer: new cotton insecticide

A new, highly potent insecticide will be in limited use this year against cotton insects. Endrin—closely related chemically to dieldrin—has been found by ARS entomologists to be the best insecticide thus far tested against the combination of bollworm and boll weevil.

As little as 0.15 to 0.25 pound of endrin per acre gives longer control with one application than toxaphene, the only other single insecticide recommended for both bollworm and boll weevil. Endrin also controls thrips, leafworm, fleahopper, and other cotton insects. It's not effective against the pink bollworm or spider mite.

Endrin was tested in 1953 under widely divergent conditions. At Florence, S. C., its use raised seed-cotton yields as much as 746 pounds per acre. In Mexico it controlled a heavy boll-weevil infestation so successfully that seed-cotton yields increased 1,071 pounds per acre.

Endrin is toxic to warm-blooded animals, so users are cautioned to follow recommendations on the label.☆

Threat: white-pine pole blight

Forest Service pathologists, in cooperation with the University of Idaho, are engaged in an uphill fight to save western white pine from pole blight. It threatens 750,000 acres of future timber in Idaho, Washington, and Montana, and is widespread in British Columbia.

This disease strikes pole-sized trees past about 40 years old. Early symptoms are yellow, sparse foliage, and shortened needles and terminal branches. Bark lesions and excessive resin flow may be found. Pole blight seems to mean certain death for affected trees.

Researchers are trying to determine the nature of the disease and find a way to control it or cut losses.☆

Report: mothproofer catches on

At least 80 firms are now making EQ–53—chemical material for mothproofing washable woolens—announced in our first issue (Agr. Res., Jan.–Feb. 1953).

ARS has made a vigorous effort to let housewives know they can now protect blankets, sweaters, and similar woolens simply by adding EQ–53 to wash or rinse water.

The story was picked up by many newspapers, trade publications, regional papers, and national magazines.

Directions for using EQ–53 were published last April in Home and Garden Bulletin 24, "Clothes Moths and Carpet Beetles: How to Combat Them." Demand was so great that nearly 100,000 copies have been distributed.

ARS hasn't received a single consumer complaint about EQ–53, which was developed at the Stored-product Insects Laboratory, Savannah, Ga. Entomologists hope there'll be plenty on retailers' shelves this spring.☆

Prospect: potatoes in film bags

Potatoes packaged in film as transparent as a goldfish bowl speed the housewife's shopping and have proved first-rate sellers in research at the Ohio experiment station. The Maine experiment station also is working on this marketing development.

Prospect is that many potatoes will be bagged this way, once all problems are solved. A good many hurdles have already been crossed: small holes in the tight-closed film bags now keep them from getting badly fogged inside . . . clamping the soft, floppy bags to the end of a chute makes it easy to fill them quickly . . . washing now precedes packaging so the potatoes don't look earthy, and newer dry-cleaning methods are proposed . . . layers of paper, burlap, or cotton between film bags helps stack them more solidly . . . price of 5-pound film bags—once 3 or 4 cents each—is now in line with the cost of other bags.

Still on the list of problems is some breakage of the plastic-film bags during handling and shipping.☆

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